APPENDIX I
2006 SEDIMENT ASSESSMENT - BANK EROSION AND UNPAVED ROADS

St. Regis TMDL Planning Area

Prepared for:

Montana Department of Environmental Quality
c/o Darrin Kron
P.O. Box 200901
Helena, MT 59620-0901

Prepared by:

PBS&J
P.O. Box 239
Helena, MT 59624

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INTRODUCTION

This report presents an assessment of sediment loading to streams listed as impaired due to sediment in the St. Regis TMDL Planning Area (TPA). Sediment loading due to streambank erosion, sediment inputs from the unpaved road network on non-federally managed lands, and sediment inputs from mass wasting were estimated based on field data collected in 2006. Streambank erosion data was collected at all observed eroding banks on the St. Regis River, Big Creek, Twelvemile Creek and Little Joe Creek, while sediment inputs from unpaved roads were assessed at a subset of identified unpaved road crossings on non-federally managed lands. Sediment inputs from mass wasting were estimated for eroding hillslopes observed along the St. Regis River and Twelvemile Creek. Additional information regarding this assessment can be found in *Field Monitoring and Temperature Modeling Sampling and Analysis Plan for the 2006 Field Season* (MDEQ 2006a).

Sediment Impairments

On the 1996 303(d) List, the St. Regis River, Little Joe Creek, North Fork Little Joe Creek, and Twelvemile Creek were listed as impaired due to sediment. On the 2004 303(d) List, the St. Regis River, Big Creek, Little Joe Creek, North Fork Little Joe Creek, and Twelvemile Creek were listed as impaired due to sediment.

SEDIMENT LOADING DUE TO STREAMBANK EROSION

An inventory and assessment of eroding banks was performed on the St. Regis River, Big Creek, Twelvemile Creek, Little Joe Creek, and North Fork Little Joe Creek. Sediment loading due to streambank erosion was assessed on all the stream segments listed as impaired due to sediment on the 1996 and 2004 303(d) List.

Field Data Collection and Load Calculations

Streambank erosion assessments were performed on a total of 39 eroding streambanks, including 25 streambanks on the St. Regis River, 5 streambanks along Big Creek, 2 streambanks along Little Joe Creek, and 7 streambanks along Twelvemile Creek. Along the St. Regis River, stream bank erosion assessments were performed on eroding banks visible from Interstate 90 and the Frontage Road. Since Interstate 90 parallels the St. Regis River along the majority of its length, selection of sample sites through this technique was thought to capture all of the large eroding banks and the majority of smaller eroding banks. On tributary streams, eroding bank assessment sites were selected in the field based on observations made from the forest roads paralleling the stream channel, along with information from previous assessment work. Sections of Big Creek and Twelvemile Creek away from the road were walked, providing detailed coverage for these segments. Previous assessment work, along with local inquires, did not identify any other stream segments in the watershed in which streambank erosion was a significant source of sediment. Eroding streambank locations are presented in **Figure I-1**.

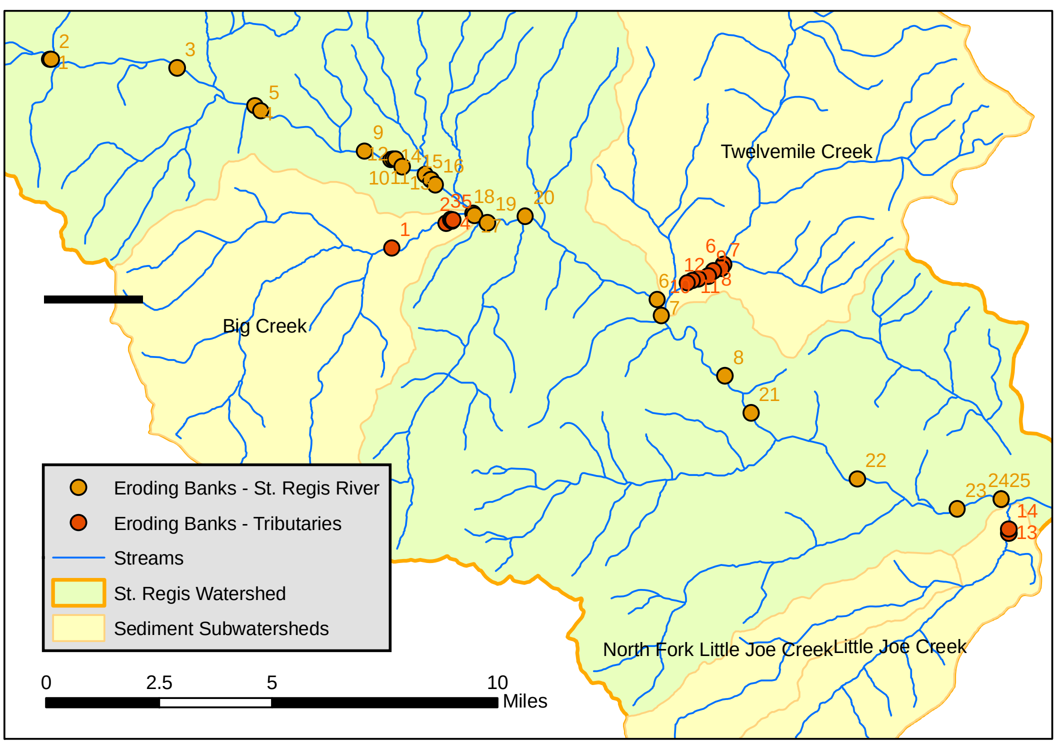

Figure I-1. Eroding Streambanks in the St. Regis TPA

Streambank Erosion Assessment Methodology

Streambank erosion was assessed by performing Bank Erosion Hazard Index (BEHI) measurements and estimating the Near Bank Stress (NBS) (Rosgen 1996, 2004). The BEHI score was determined at each eroding streambank based on the following parameters: bank height, bankfull height, root depth, root density, bank angle and surface protection. BEHI categories range from “very low” to “extreme”. At each eroding streambank, the NBS was visually estimated for a bankfull flow event. NBS categories range from “very low” to “extreme”. The length, height, and composition of each eroding streambank were noted and the source of streambank instability was identified based on the following near-stream source categories:

- Transportation
- Riparian Grazing
- Cropland
- Mining
- Silviculture
- Irrigation-shifts in stream energy
- Natural Sources
- Other

The source of streambank erosion was evaluated based on observed anthropogenic disturbances and the surrounding land-use practices. For example, an eroding streambank in an area affected by logging was assigned a source of “100% silviculture,” while an eroding streambank due to road encroachment upstream was assigned a source of “100% transportation”. If multiple sources were observed, then a percent was noted for each source, while naturally eroding streambanks were considered the result of “natural sources”. The “other” category was chosen when streambank erosion resulted from a source not described in the list. In the St. Regis TPA, observed sources of streambank erosion included transportation, cropland, silviculture, and natural sources. In addition, bank stabilization projects along Big Creek, the utility corridor along the St. Regis River and a fishing access point along the St. Regis River were identified sources of streambank erosion in the “other” category. Sources of streambank erosion for individual banks are included in the electronic database accompanying this project.

Estimating Sediment Loads from Field Data

The length of eroding streambank, mean height, and the annual retreat rate were used to determine the annual sediment input from eroding streambanks (in cubic feet). The length and mean height were measured in the field, while the annual retreat rate was determined based on the relationship between BEHI and NBS scores. Streambank retreat rates measured in the Lamar River in Yellowstone National Park (Rosgen 1996) were applied to streambanks in the St. Regis TPA (**Table I-1**). The annual sediment input in cubic feet was then converted into cubic yards (divided by 27 cubic feet per yard) and finally converted into tons per year based on the bulk density of the streambank to provide an annual sediment load.

Table I-1. Annual Streambank Retreat Rates (Feet/Year) (adapted from Rosgen 1996)

		Near Bank Stress				
		Very Low	Low	Moderate	High	Very High
BEHI	Low	0.019	0.042	0.089	0.19	
	Moderate	0.082	0.17	0.33	0.62	1.3
	High - Very High	0.29	0.44	0.7	1.1	1.7
	Extreme	0.6	0.83	1.3	1.7	2.3

Streambank Composition

Bulk density of streambanks in the St. Regis TPA was determined based on streambank composition data collected in the field and standard soil weights compiled by the U.S Department of the Interior (USDI 1998). Soil weights in the "well-graded" category were selected to most accurately reflect streambank composition, since "well-graded" suggests a wide array of size classes, which is likely what is found in nature. Streambank composition data from the St. Regis River, Big Creek and Twelvemile Creek most closely resembles the soil group described as "well-graded gravel with silt". Based on the minimum value of the USDI dry unit weight for "well-graded gravel with silt," a value of 89 pounds/foot^3 (1.20 tons/yard^3) was estimated as the average weight of the streambank material (USDI 1998). The minimum value was selected to account for plant roots within the streambank that would decrease the overall soil density. Streambank composition data from Little Joe Creek most closely resembles the soil group described as "well-graded sand". Based on the minimum value of the USDI dry unit weight for "well-graded sand," a value of 107 pounds/foot^3 (1.44 tons/yard^3) was estimated as the average bulk density of streambank material (USDI 1998).

Streambank Erosion on Listed Stream Segments

Sediment loading due to streambank erosion was estimated for the St. Regis River, Big Creek, Little Joe Creek, and Twelvemile Creek. Estimated sediment loads are provided for each stream segment in the following sections.

St. Regis River

Eroding streambank assessments were performed at all observed eroding streambanks along the St. Regis River. A total of 25 eroding streambanks were assessed covering 1.3 miles (6,601 feet) of stream. A total sediment load of 518.1 tons/year was attributed to eroding streambanks (**Table I-2**). Along the St. Regis River, 75% of the bank erosion was attributed to transportation, 7% was attributed to croplands, 3% was attributed to natural sources, and 15% was attributed to "other," which refers primarily to utility corridor infrastructure maintenance that has resulted in the clearing of vegetation along the stream corridor. The impact of the transportation corridor on streambank erosion results from extensive channelization and the placement of rock riprap associated with Interstate 90 and the historic railroads, which has lead to increased stream power along "unprotected" streambanks.

Much of the streambank erosion along the St. Regis River was observed in a wide and aggraded area near Haugen, where 7 eroding streambanks were assessed upstream of the Big Creek Road crossing (BEHI measurements 10-16) and 3 eroding streambanks were assessed downstream of the road crossing (BEHI measurements 17-19). A sediment load of 249.5 tons/year was estimated due to streambank erosion around the Haugan area. This accounts for 48% of the total sediment load due to streambank erosion along the St. Regis River. Sediment loading due to the shifting of sparsely vegetated gravel bars likely represents an additional source of sediment within this area, though this additional sediment load was not quantified in the streambank erosion assessment. This gravel bar complex is comprised of a sediment size class that would most likely affect overall channel form, including pool formation, rather than contributing to the concentration of fine sediment. A high capacity for sediment transport upstream of this reach due to extensive channelization is the likely reason for aggradation in this relatively wide and flat area. A second area of aggradation along the St. Regis River was observed downstream of the Little Joe Creek confluence, though no eroding banks were noted. Sediment loading due to shifting unvegetated gravel bars in this area may also be significant.

Figure I-2. Eroding Streambanks in the Haugan Vicinity

Big Creek

Eroding streambank assessments were performed at all observed eroding banks along the mainstem of Big Creek (BEHI measurements 1-5). A total of 5 eroding streambanks were assessed covering 0.1 miles (555 feet) of stream. A total sediment load of 45.5 tons/year was attributed to eroding streambanks (**Table I-2**). Along Big Creek, 30% of the bank erosion was attributed to transportation, 30% was attributed to silviculture, 10% was attributed to natural sources, and 30% was attributed to "other," which refers primarily to streambank stabilization projects performed at several large eroding streambanks near the mouth of Big Creek. Silviculture was cited as a source at sites which may have been influenced by increased sediment loads and water yields due to logging within the upper watershed, while transportation was cited as a source due to a bridge which constricts the floodplain area, leading to bank erosion on the downstream bends.

Bank erosion along Big Creek was primarily observed in the lower reach of the stream near the confluence with the St. Regis River. This area was over-widened with tall exposed banks on which streambank stabilization projects have been implemented. Previous streambank stabilization projects were implemented on at least 4 eroding streambanks with varying levels of success, while a new streambank stabilization project was performed on one bank immediately prior to field data collection in September of 2006.

Little Joe Creek

Eroding streambank assessments were performed at all observed eroding streambanks along the mainstem of Little Joe Creek (BEHI measurements 13 and 14). A total of 2 eroding streambanks were assessed covering 0.02 miles (96 feet) of stream. A total sediment load of 36.4 tons/year was attributed to eroding streambanks (**Table I-2**). Along Little Joe Creek, 100% of the streambank erosion was attributed to silviculture. The majority of the observed streambank erosion resulted from a slumped hillslope that is revegetating.

North Fork Little Joe Creek

No streambank erosion was observed along North Fork Little Joe Creek, which is paralleled by Little Joe Creek Road along much of its length. North Fork Little Joe Creek is a moderately steep mountain stream with streambanks comprised of large gravels and cobbles that are highly resistant to erosion.

Twelvemile Creek

Eroding streambank assessments were performed at all observed eroding streambanks along the mainstem of Twelvemile Creek (BEHI measurements 6-12). A total of 7 eroding streambanks were assessed covering 0.2 miles (1,041 feet) of stream. A total sediment load of 47.8 tons/year was attributed to eroding streambanks (**Table I-2**). Along Twelvemile Creek, 88% of the streambank erosion was attributed to transportation, 5% was attributed to silviculture, and 7% was attributed to natural sources. The majority of the observed streambank erosion was in the

lower portion of Twelvemile Creek where the stream has been channelized by Camels Hump Pass Highway.

Along Twelvemile Creek, two large eroding hillslopes were included in the eroding bank assessment (BEHI measurements 11 and 12) since it appeared that sediment at the base of these hillslopes was readily transported at bankfull and higher flows. In order to keep sediment contributions due to streambank erosion separate from sediment contributions due to hillslope erosion, the mean bank height was considered to be the height at the floodprone elevation (2x maximum bankfull depth). In the reach between the National Forest boundary and the mouth in which these two hillslopes were located, an average maximum depth of 2.3 feet was measured during stream channel assessments in 2004. Thus, the mean bank height for these two banks was set at 4.6 feet for sediment load calculation purposes.

Table I-2. Sediment Loads due to Eroding Streambanks in the St. Regis TPA by Source

Stream Segment	Stream Segment Length (Miles)	Sediment Load	Sources					Total Load
			Transportation	Cropland	Silviculture	Natural Sources	Other	
St. Regis River	38.6	Tons/Year	389.1	35.3	0.0	16.6	77.8	518.7
		Percent	75%	7%	0%	3%	15%	
Big Creek	3.4	Tons/Year	13.9	0.0	13.7	4.5	13.4	45.5
		Percent	30%	0%	30%	10%	30%	
Little Joe Creek	3.1	Tons/Year	0.0	0.0	36.4	0.0	0.0	36.4
		Percent	0%	0%	100%	0%	0%	
Twelvemile Creek	13.4	Tons/Year	42.2	0.0	2.3	3.3	0.0	47.8
		Percent	88%	0%	5%	7%	0%	

SEDIMENT LOADING FROM UNPAVED ROADS

An assessment of sediment loading from unpaved roads on non-federally managed lands was undertaken to provide a comparison to sediment loading from federally managed lands. Several unpaved road crossings on National Forest lands were also examined. This assessment is complimentary to the assessment performed by the Lolo National Forest on federally managed lands, which is described in Appendix G (Item 4: Sediment Analysis) of the *Draft St. Regis Watershed Water Quality Restoration Plan: Sediment and Temperature TMDLs* completed in June of 2006 (MDEQ 2006b). While the Lolo National Forest comprises the vast majority of the St. Regis River TPA, additional land owners include Plum Creek Timber Company, Montana State Trust Lands, and private lands. In this assessment, the unpaved road network outside of the Lolo National Forest will be described as roads occurring on "non-federally" managed lands. However, some of these roads are maintained by the Lolo National Forest.

Field Data Collection

Prior to field data collection, the number of unpaved road crossings on non-federally managed lands was determined using GIS. A total of 52 unpaved crossings were identified and a subset of 10 crossings was selected for field data collection. In 2006, data was collected at 9 sites on private lands. In addition, data was collected at 16 sites on the Lolo National Forest. Of the 9 sites assesses on non-federally managed lands, 4 of the sites (SR-X-32, SR-X-27, SR-X-22 and SR-X-13) were on roads maintained by the Lolo National Forest, 2 of the sites (SR-X-14 and SR-X-3) were maintained by Mineral County, and 3 of the sites (SR-X-185, SR-X-20 SR-X-40) were privately maintained. At each unpaved road assessment site the following parameters were collected:

- Road design
- Road surface
- Traffic level
- Road grade
- Road length
- Road width
- Fill grade
- Fill length
- Buffer grade
- Buffer width
- Rock content

WEPP Model

The WEPP:Road model was used to estimate sediment loads from unpaved roads in the St. Regis TPA. The WEPP:Road model provides an estimate of sediment runoff from unpaved roads based on physical road characteristics, the soil type on which the road occurs and the climate. Physical road characteristics used in the model were measured in the field. The soil type used in the model was determined based on the National Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database, which is available at

http://www.mt.nrcs.usda.gov/soils/mtsoils/official.html. The Wallace Idaho climate station was used in the model, with an average annual precipitation of 36 inches. This is the same climate station used in the assessment performed by the Lolo National Forest. WEPP:Road batch results were run using version 2006.09.04, which is based on WEPP version 2000.100. Sediment loads were modeled as annual loads over a 30-year period. WEPP:Road input data are presented in **Attachment A**. WEPP:Road input data with the application of Best Management Practices in present in **Attahcment B**. Additional information regarding the WEPP model can be found at http://forest.moscowfsl.wsu.edu/fswepp/.

When field data was entered into the model it was determined that several field measured parameters needed to be slightly adjusted to meet the input requirements of the WEPP:Road Model. The following adjustments were made:

1. Fill gradient/length and buffer gradient/length cannot be reported as zero in the model. Minimum values allowed by the model (0.3 for gradient and 1 for length) were used when zero values were entered on the field form.
2. Contributing road length cannot exceed 1000 feet. Road lengths exceeding 1000 feet were reduced to 1000 feet.
3. Buffer gradient cannot exceed 100%. Buffer gradients exceeding 100% were reduced to 100%.
4. Traffic levels of High, Low and None are available in the model. Traffic levels reported as “Moderate” on the field forms were reduced to “Low” in the model.

Non-Federally Managed Lands

A total of nine crossings on non-federally managed lands were assessed in 2006 (**Figure I-3**). Six crossings occurred on silt loam soils, one crossing occurred on a clay loam soil, and the remaining two crossings occurred on soils described in the SSURGO soils database as “Alluvial Lands,” which were estimated to be “sandy loam” soils in the WEPP model. The WEPP model predicted that 0.0052 tons/year of sediment are delivered to the stream channel (“mean annual sediment leaving buffer”) (**Table I-3**). Extrapolating the sediment load from the assessed sites to the 52 crossings on non-federally managed lands indicates 0.27 tons of sediment are delivered to stream channels each year. Through the application of Best Management Practices (BMPs) that could reduce contributing road lengths to a maximum of 200 feet at each crossing (100 feet from either side), the WEPP model predicted annual sediment delivery could be reduced to 0.0035 tons/year from the nine assessed sites and 0.18 tons/year from all 52 crossings. Thus, the application of BMPs could reduce sediment inputs by 33% from unpaved road crossings on non-federally managed lands. This is based on an assessment of 17% of the unpaved crossings on non-federally managed lands in the St. Regis River watershed.

Table I-3. WEPP Modeled Sediment Loads from Road Crossings on Non-Federally Managed Lands

Site	Soil Type	Mean Annual Sediment Leaving Buffer (Tons)	Mean Annual Sediment Leaving Buffer with BMPs (Tons)
SR-X-32	silt loam soil	0.002	0.001
SR-X-27	silt loam soil	0.006	0.003
SR-X-185	silt loam soil	0.001	0.001
SR-X-14	silt loam soil	0.006	0.003
SR-X-22	silt loam soil	0.003	0.002
SR-X-20	silt loam soil	0.002	0.001
SR-X-40	sandy loam soil	0.000	0.000
SR-X-3	sandy loam soil	0.028	0.021
SR-X-13	clay loam soil	0.001	0.001
Mean Annual Sediment Load from Assessed Sites		**0.0052**	**0.0035**
Total Sediment Load from Non-Federally Managed Lands		**0.27**	**0.18**
Potential Reduction in Sediment Load		**0.09**	
Percent Reduction in Sediment Load		**33%**	

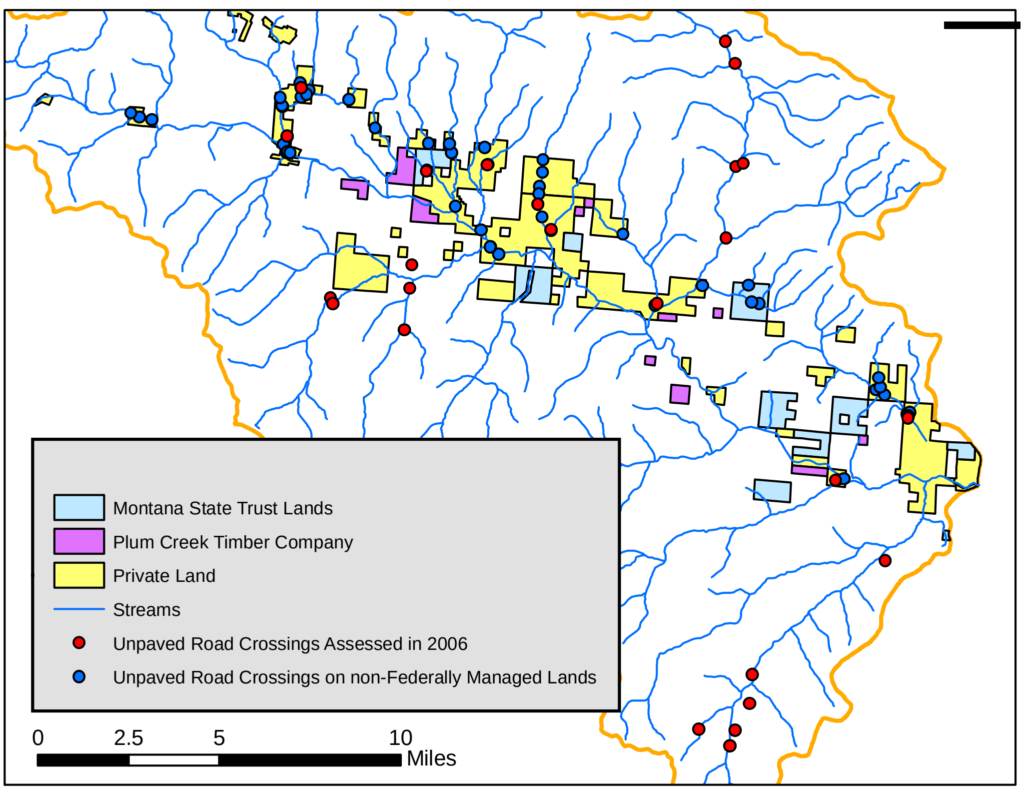

Figure I-3. Unpaved Road Assessment Sites

National Forest Lands

A total of 16 unpaved road sediment sources were assessed on National Forest lands in 2006, with 14 crossings and 2 near-stream road segments (**Figure I-3**). Since the SSURGO soils database lacked information on National Forest lands, the "silt loam" type was used in the WEPP model to provide a "worst case scenario" estimate based on the most erosive soil type within the St. Regis watershed. The WEPP model predicted an average sediment load of 0.53 tons/year leaving the buffer for each unpaved road crossing (**Table I-4**). Application of BMPs to reduce the contributing road length to a maximum of 400 feet at each crossing (200 feet from either side) could lead to an average sediment load of 0.27 tons/year leaving the buffer. Thus, the application of BMPs could reduce sediment inputs by 48% from unpaved road crossings on National Forest lands. Table 4S-5 in Appendix G of the *Draft St. Regis Watershed Water Quality Restoration Plan: Sediment and Temperature TMDLs* (MDEQ 2006b) indicates there are 621 unpaved road crossings on the Lolo National Forest in the St. Regis River watershed. Thus, 2% of the unpaved crossings were considered in this assessment.

Table I-4. WEPP Modeled Sediment Loads from Road Crossings on National Forest Lands

Site	Mean Annual Sediment Leaving Buffer (Tons)	Mean Annual Sediment Leaving Buffer with BMPs (Tons)
USFS-02	1.73	1.18
USFS-03	0.71	0.10
USFS-04	1.14	0.77
USFS-05	0.01	0.01
USFS-06	0.58	0.19
USFS-07	0.05	0.05
USFS-08	1.28	0.51
USFS-10	0.48	0.11
USFS-11	0.00	0.00
USFS-12	0.00	0.00
USFS-13	0.01	0.01
USFS-14	0.00	0.00
USFS-15	0.00	0.00
USFS-16	1.39	0.90
Mean Annual Sediment Load from Assessed Sites	**0.53**	**0.27**
Potential Reduction in Sediment Load	**0.25**	
Percent Reduction in Sediment Load	**48%**	

Watershed Sediment Loads

Sediment loading from unpaved roads at the watershed scale for Big Creek, Little Joe Creek, Twelvemile Creek and the St. Regis River was determined based on modeled sediment loads from both National Forest and non-federally managed lands. Table 4S-5 in Appendix G of the *Draft St. Regis Watershed Water Quality Restoration Plan: Sediment and Temperature TMDLs* (MDEQ 2006b) indicates there are 621 unpaved road crossings on National Forest land in the St. Regis River watershed, with 40 crossings in the Big Creek watershed, 83 crossings in the Little Joe Creek watershed, 30 crossings in the North Fork Little Joe Creek watershed, and 142

crossings in the Twelvemile Creek watershed. The crossing estimates assume that GIS analysis over-estimated the number of crossings by 20-30%. An additional 2 crossings were identified on non-federally managed lands in the Big Creek watershed, while 6 additional crossings were identified in the Twelvemile Creek watershed. In the St. Regis TPA, there are an estimated 52 crossings on non-federally managed lands. Throughout the St. Regis TPA, an estimated 33% reduction in sediment loads can be achieved on non-federally managed lands (**Table I-5**) and an estimated 48% reduction in sediment loads can be achieved on National Forest lands (**Table I-6**). Total sediment loads from unpaved roads in the St. Regis TPA are estimated at 327.5 tons/year (**Table I-7**). Through the application of BMPs, it is estimated that the sediment load could be reduced by 157.2 tons/year, which is a 48% reduction in sediment loading.

Table I-5. Sediment Loads from Unpaved Road Crossings on Non-Federally Managed Lands

Watershed	Estimated Number of Unpaved Road Crossings	Mean Sediment Load per Crossing (Tons/Year)	Total Sediment Load (Tons/Year)	Mean Sediment Load per Crossing with BMPs Limiting Contributing Length to 200 Feet (Tons/Year)	Total Sediment Load with BMPs Limiting Contributing Length to 200 Feet (Tons/Year)	Potential Load Reduction (Tons/Year)	Percent Reduction
Big Creek	2	0.0052	0.01	0.0035	0.0070	0.0034	33%
Little Joe Creek	0	0.0052	0.00	0.0035	0.0000	0.0000	0%
North Fork Little Joe Creek	0	0.0052	0.00	0.0035	0.0000	0.0000	0%
Twelvemile Creek	6	0.0052	0.03	0.0035	0.0210	0.0102	33%
St. Regis River	52	0.0052	0.27	0.0035	0.1820	0.0884	33%

Table I-6. Sediment Loads from Unpaved Road Crossings on National Forest Lands

Watershed	Estimated Number of Unpaved Road Crossings	Mean Sediment Load (Tons/Year)	Total Sediment Load (Tons/Year)	Mean Sediment Load per Crossing with BMPs Limiting Contributing Length to 400 Feet (Tons/Year)	Total Sediment Load with BMPs Limiting Contributing Length to 400 Feet (Tons/Year)	Potential Load Reduction (Tons/Year)	Percent Reduction
Big Creek	40	0.527	21.1	0.274	11.0	10.1	48%
Little Joe Creek	83	0.527	43.7	0.274	22.7	21.0	48%
North Fork Little Joe Creek	30	0.527	15.8	0.274	8.2	7.6	48%
Twelvemile Creek	142	0.527	74.8	0.274	38.9	35.9	48%
St. Regis River	621	0.527	327.3	0.274	170.2	157.1	48%

Table I-7. Sediment Loads from Unpaved Road Crossings in the St. Regis TPA

Watershed	Estimated Number of Unpaved Road Crossings	Total Sediment Load (Tons/Year)	Sediment Load with BMPs (Tons/Year)	Potential Load Reduction (Tons)	Percent Reduction
Big Creek	42	21.1	11.0	10.1	48%
Little Joe Creek	83	43.7	22.7	21.0	48%
North Fork Little Joe Creek	30	15.8	8.2	7.6	48%
Twelvemile Creek	148	74.9	38.9	35.9	48%
St. Regis River	673	327.5	170.3	157.2	48%

SEDIMENT LOADING DUE TO MASS WASTING

Sediment loading due to mass wasting was estimated for two large eroding hillslopes along the St. Regis River and two large eroding hillslopes along Twelvemile Creek using the Disturbed WEPP model, which is available at http://forest.moscowfsl.wsu.edu/fswepp/. In the model, the "Low Severity Fire" disturbance was selected since this was "the most appropriate treatment to describe a sparsely vegetated, newly exposed surface following excavation where material has not been highly compacted, such as a road cut" (Elliot et al. 2000). While these surfaces are not freshly exposed, they did resemble road cuts and this description was determined to be the most accurate out of the available selections. Input parameters for gradient, horizontal length, percent cover and percent rock were derived through field data and a review of field photographs. As in the WEPP:Road model, the Wallace Idaho climate station was used and sediment loads were simulated over a thirty year period. Disturbed WEPP input data and estimated sediment loads are presented in **Attachment C**.

St. Regis River

Two large eroding hillslopes were identified along the St. Regis River. The development of the transportation corridor along the St. Regis River was the identified source of hillslope erosion. Field observations indicated that the old highway may have been primarily responsible for erosion of "Hillslope 1" and the railroad may have been primarily responsible for erosion of "Hillslope 2," though channelization, which increased as the transportation corridor was developed, is also likely influencing erosion at both sites. Soils information was lacking for these sites, though the "silt loam" soil was selected based on other soils within the watershed where SSURGO database coverage was available. From "Hillslope 1," the estimated annual sediment load was 6.24 tons/year, while "Hillslope 2" produced 3.74 tons year. The WEPP Disturbed model indicated a 97% delivery rate for this sediment load.

Table I-8. Hillslope Inputs along the St. Regis River

Field Data		WEPP Results	Sediment Erosion from Hillslope (Tons/Year)
Stream Segment	**Site**	**Average Sediment (Tons/Acre)**	
St. Regis River	Hillslope 1	11.05	6.24
St. Regis River	Hillslope 2	13.91	3.74

Twelvemile Creek

Two large eroding hillslopes were identified along the lower reaches of Twelvemile Creek. Channelization caused by the Camel Hump Pass Highway was the source of erosion for both hillslopes, while logging above the eroding hillslopes may have exacerbated the situation. The "silt loam" soil type was selected based on the SSURGO database. From "BEHI 1," the estimated annual sediment load was 2.20 tons/year, while "BEHI 2" produced 1.20 tons year. The WEPP Disturbed model indicated a 93% delivery rate for this sediment load.

Table I-9. Hillslope Inputs along Twelvemile Creek

Field Data		WEPP Results	Sediment Erosion from Hillslope (Tons/Year)
Stream Segment	Site	Average Sediment (Tons/Acre)	
Twelvemile Creek	BEHI 11	7.50	2.20
Twelvemile Creek	BEHI 12	9.19	1.20

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ATTACHMENT A

WEPP:ROAD INPUT

Middle and Lower Big Hole River TMDL Planning Areas

Field Data			WEPP Batch Input Specifications											
Site	**Latitude**	**Longitude**	**Road Design**	**Road Surface**	**Traffic Level**	**Road Gradient**	**Road Length**	**Road Width**	**Fill Gradient**	**Fill Length**	**Buffer Gradient**	**Buffer Length**	**Rock Fragment**	**Comment**
SR-X-32	47.32148	115.13473	OU	N	L	2	300	25	0.3	1	2	12	10	SR-X-32
SR-X-13	47.29456	115.17455	OU	N	L	2	180	15	5	5	3	15	10	SR-X-13
SR-X-27	47.35964	115.28656	OU	G	L	5	400	25	100	10	3	40	40	SR-X-27
SR-X-40	47.39559	115.36071	OU	N	L	2	520	15	35	6	2	30	10	SR-X-40
SR-X-185	47.38581	115.35213	OU	G	L	2	350	15	0.3	1	3	15	40	SR-X-185
SR-X-14	47.40953	115.39222	OU	N	L	8	355	23	40	10	4	25	10	SR-X-14
SR-X-22	47.40513	115.42736	OU	G	L	2	270	24	0.3	1	3	10	40	SR-X-22
SR-X-3	47.41498	115.51086	OU	G	H	2	260	26	90	10	10	10	40	SR-X-3
SR-X-20	47.43462	115.50468	OU	N	L	5	350	14	0.3	1	3	8	10	SR-X-20
USFS-01	47.36757	115.43198	IV	G	H	5	410	16	0.3	1	0.3	1	40	USFS-01
USFS-02	47.35814	115.43198	IB	N	H	8	480	18	0.3	1	5	15	10	USFS-02
USFS-03	47.35214	115.47796	IV	N	L	5	1000	12	0.3	1	40	3	15	USFS-03
USFS-04	47.35000	115.47653	OR	N	L	11	480	12	110	30	40	30	20	USFS-04
USFS-05	47.34148	115.43340	OU	N	L	2	344	18	100	15	100	30	10	USFS-05
USFS-06	47.38758	115.24879	IV	G	H	3	1000	18	40	10	90	50	20	USFS-06
USFS-07	47.41616	115.24634	IV	G	H	1	121	35	110	5	30	25	30	USFS-07
USFS-08	47.41762	115.24218	IB	N	L	7	600	12	50	10	50	20	10	USFS-08
USFS-09	47.45707	115.25112	IV	G	H	6	1000	27	50	2	100	3	35	USFS-09
USFS-10	47.46563	115.25772	IB	G	L	5	1000	24	20	2	20	35	50	USFS-10
USFS-11	47.26439	115.14196	OU	G	L	4	100	21	60	8	10	30	30	USFS-11
USFS-12	47.18640	115.22499	OU	N	L	5	150	13	0.3	1	70	20	15	USFS-12
USFS-13	47.19268	115.22263	OU	N	L	4	150	13	0.3	1	50	1	5	USFS-13
USFS-14	47.20357	115.21542	OU	N	L	6	120	14	0.3	1	100	8	5	USFS-14
USFS-15	47.19200	115.24384	OU	N	L	4	150	21	0.3	1	10	35	15	USFS-15
USFS-16	47.21515	115.21509	IV	N	H	6	500	15	100	15	0.3	1	10	USFS-16

ATTACHMENT B

WEPP:ROAD INPUT WITH BMPS

Middle and Lower Big Hole River TMDL Planning Areas

Field Data			WEPP Batch Input Specifications											
Site	**Latitude**	**Longitude**	**Road Design**	**Road Surface**	**Traffic Level**	**Road Gradient**	**Road Length**	**Road Width**	**Fill Gradient**	**Fill Length**	**Buffer Gradient**	**Buffer Length**	**Rock Fragment**	**Comment**
SR-X-32	47.32148	115.13473	OU	N	L	2	200	25	0.3	1	2	12	10	SR-X-32
SR-X-13	47.29456	115.17455	OU	N	L	2	180	15	5	5	3	15	10	SR-X-13
SR-X-27	47.35964	115.28656	OU	G	L	5	200	25	100	10	3	40	40	SR-X-27
SR-X-40	47.39559	115.36071	OU	N	L	2	200	15	35	6	2	30	10	SR-X-40
SR-X-185	47.38581	115.35213	OU	G	L	2	200	15	0.3	1	3	15	40	SR-X-185
SR-X-14	47.40953	115.39222	OU	N	L	8	200	23	40	10	4	25	10	SR-X-14
SR-X-22	47.40513	115.42736	OU	G	L	2	200	24	0.3	1	3	10	40	SR-X-22
SR-X-3	47.41498	115.51086	OU	G	H	2	200	26	90	10	10	10	40	SR-X-3
SR-X-20	47.43462	115.50468	OU	N	L	5	200	14	0.3	1	3	8	10	SR-X-20
USFS-02	47.35814	115.43198	IB	N	H	8	400	18	0.3	1	5	15	10	USFS-02
USFS-03	47.35214	115.47796	IV	N	L	5	400	12	0.3	1	40	3	15	USFS-03
USFS-04	47.35000	115.47653	OR	N	L	11	400	12	110	30	40	30	20	USFS-04
USFS-05	47.34148	115.43340	OU	N	L	2	344	18	100	15	100	30	10	USFS-05
USFS-06	47.38758	115.24879	IV	G	H	3	400	18	40	10	90	50	20	USFS-06
USFS-07	47.41616	115.24634	IV	G	H	1	121	35	110	5	30	25	30	USFS-07
USFS-08	47.41762	115.24218	IB	N	L	7	400	12	50	10	50	20	10	USFS-08
USFS-10	47.46563	115.25772	IB	G	L	5	400	24	20	2	20	35	50	USFS-10
USFS-11	47.26439	115.14196	OU	G	L	4	100	21	60	8	10	30	30	USFS-11
USFS-12	47.18640	115.22499	OU	N	L	5	140	13	0.3	1	70	20	15	USFS-12
USFS-13	47.19268	115.22263	OU	N	L	4	150	13	0.3	1	50	1	5	USFS-13
USFS-14	47.20357	115.21542	OU	N	L	6	120	14	0.3	1	100	8	5	USFS-14
USFS-15	47.19200	115.24384	OU	N	L	4	150	21	0.3	1	10	35	15	USFS-15
USFS-16	47.21515	115.21509	IV	N	H	6	400	15	100	15	0.3	1	10	USFS-16

ATTACHMENT C

DISTURBED WEPP INPUT

Middle and Lower Big Hole River TMDL Planning Areas

Field Data							WEPP Input						WEPP Results	Sediment Erosion from Hillslope (Tons/Year)
Stream Segment	**Site**	**Latitude**	**Longitude**	**Height (Feet)**	**Width (Feet)**	**Area (Acres)**	**Element**	**Treatment**	**Gradient**	**Horizontal Length**	**Cover (%)**	**Rock (%)**	**Average Sediment (Tons/Acre)**	
St. Regis River	Hillslope 1	47.41811	-115.62022	60	410	0.56	**Upper**	**Low Severity Fire**	100 100	60	20	70	11.0493	6.24
							Lower	**Low Severity Fire**	100 0	60	20	70		
St. Regis River	Hillslope 2	47.40453	-115.49011	65	180	0.27	**Upper**	**Low Severity Fire**	0 100	65	0	60	13.9107	3.74
							Lower	**Low Severity Fire**	100 0	65	0	60		
Twelvemile Creek	BEHI 11	47.36097	-115.27877	25	511	0.29	**Upper**	**Low Severity Fire**	0 100	25	10	40	7.4983	2.20
							Lower	**Low Severity Fire**	100 0	25	10	40		
Twelvemile Creek	BEHI 12	47.36000	-115.28102	35	163	0.13	**Upper**	**Low Severity Fire**	0 100	35	10	40	9.1892	1.20
							Lower	**Low Severity Fire**	100 0	35	10	40		